

Flight validation of cruise efficient, low noise, Extreme short takeoff and landing (CESTOL) and circulation control (CC) for drag reduction enabling technologies

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Purpose

The primary objective of this Seedling Fund research is to develop and prepare for flight, an innovative, affordable test bed aircraft that will allow integrated flight-propulsion control law and aircraft systems development, system integration, measurement of integration effects on performance, and early flight evaluation of circulation control technologies such as Cruise Efficient Short Takeoff and Landing (CESTOL) and Fundamental Aerodynamics Subsonic Transonic Modular Active Control (FAST-MAC) either separately or in combination. Once developed, the test bed aircraft will allow researchers to evaluate circulation control technologies in a flight environment and develop the technology for future commercial applications.

The secondary objective of this effort is to develop tools for circulation control flight research. A six degree of freedom nonlinear flight simulation of the vehicle will be developed for the research community. The simulation will include the baseline aircraft as well as the circulation control data. Simulation data will come from wind tunnel tests and flight tests of the aircraft. These tools will help researchers develop flight controls and algorithms which can then be flown on the test bed.

Background

The number of flight operations at many of the nation's largest airports is projected to increase in the future. In order to meet increased mobility needs, the Next Generation Air Transportation System (NextGen) will rely on the expanded use of secondary and reliever airports which will employ a new class of vehicles that are capable of short take-off and landing (STOL).

Individual technologies to enable these future vehicles are being developed on computers, being built in laboratories and being tested in wind tunnels. Wind tunnel tests of FAST-MAC and AMELIA have yielded a wealth of aerodynamic data for circulation control.

Integration of these technologies with other aircraft systems and performance evaluation in a flight environment is critical in developing these future STOL vehicles but is not currently a focus of the NASA Fixed Wing program. This is in part due to the high cost of developing and operating a research test bed aircraft.

Under this project, a highly flexible and affordable circulation control research test bed and associated tools will be developed to increase TRL of technologies developed in the lab and wind tunnel.